IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Automating Flower Recognition: A Convolutional Neural Network Approach

[1]Mugi Ganesh, Student in Dept. Of Master of Computer Applications, at Miracle Educational Society Group of Institutions

[2]Mr. G. Rajasekharam, Associate Professor at Miracle Educational Society Group of Institutions

[3]Tata Narasimha Murthy, Associate Professor at Miracle Educational Society Group of Institutions

ABSTRACT

The goal of this paper is to identify flower varieties in conjunction with Kaggle Flowers dataset employing Convolutional Neural Networks (CNNs). The dataset contains images of five classes of flowers being, daisy, dandelion, rose, sunflower, and tulip. A classifier based on CNN was developed based on 4323 images and was able to attain a classification accuracy rate of 99.09%. The framework displays an efficient interface where users can upload images of flowers with hopes of obtaining an accurate classification. The model performance was improved by implementing data augmentation and multi-level design of CNN enabling the model to accommodate images variability. This application is useful in areas such as botany, gardening and retail sector because it helps people to use images in identifying and selecting their opportunities faster and more accurately. The project demonstrates the efficiency of CNN networks as applied in image classification and their future use into practice.

Keywords: Flower,CNN

INTRODUCTION:

Flowers have an astonishing variety of shapes, colors and scents and are as important in nature as in human's life. They form biological centers offering food, as well as shelter to a lot of animal species. Economically and culturally flowers are very much important in decoration, medicine and cuisines. The task of automatic flower recognition is a particular computer vision task where the system can automatically recognize images of flower varieties based on trained data. This has numerous uses such as identifying native wildflower species, spring cleaning, and even sorting out flowers in a flower shop.

CNNs, which stands for Convolutional Neural Networks, have emerged as the best tool for solving computer vision problems, more specifically, the problem of image recognition. This project therefore uses CNNs to design and implement an automated flower recognition system using a very powerful and easy to use machine learning library, Keras. This flower classification system utilizes CNNs' capability to recognize and learn complex visual patterns, therefore improving efficiency and accuracy in the classification of the flowers for real world applications.

GAP IDENTIFIED BASED ON LITERATURE SURVEY:

The classification of flowers is a well-researched problem with multiple models based on machine learning and deep learning having been proposed in the past. SVMs and KNNs have been shown to struggle due to their inability to obtain information from many images making classification performance very weak. More recently, Convolutional Neural Networks (CNNs) have been seen to achieve better results in classification tasks, but many attempts which had used CNNs generalized poorly to unseen data, as they were tested on datasets that had limited variety, had not been preprocessed well enough, or both.

Real-time supportive interaction with non-technical users has not been adequately explored in the current body of literature. Many works state achieving high accuracy, but don't focus on the hands-on use for the average person. In addition, many models are trained on too small of a labeled dataset and on datasets with few categories which are not practical for a scenario that would require a large variety of flower species.

The main concerns that have been observed are the following:

1. Lack of Diversity and Augmentation in Data Sets.
2. Overlooking solutions that are application-ready and can be deployed.
3. No hyperparameter fine-tuning for building scalable and general models.
4. Vague research of user environments in context of prediction and classification of images in real-time

PROBLEM STATEMENT:

Determining the flower species from images is difficult because of the high variability of flower's appearance, such as color, size, shape, and their orientation.

Remedies

Dataset: Working with multiple images and improving its quality across various light and background conditions.

Resources: CNNs utilize a lot of resources and time, which needs to be optimized.

Generalization: Making sure the model does not memorize the training images and learns to generalize to new ones that the model has not encountered before.

Online: Achieving the required classification and speed for real-time use.

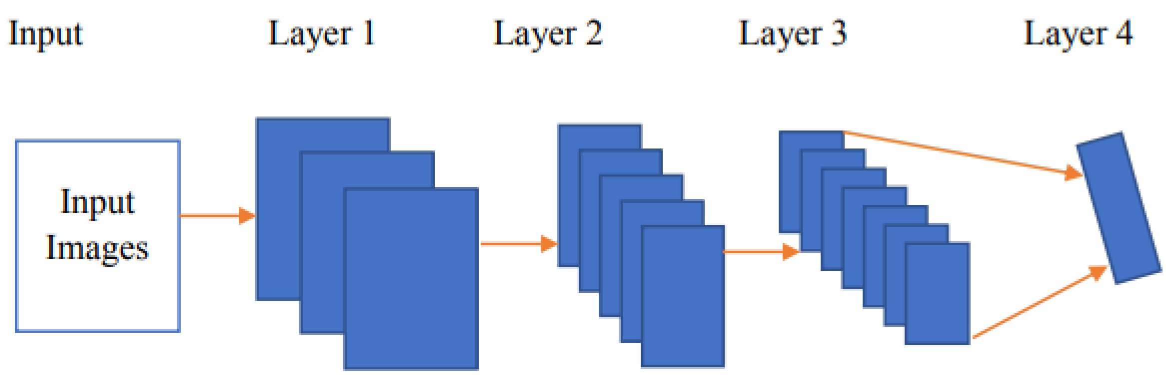
End user: The system should allow the users to upload the data and classify it easily.

PROPOSED METHOD:

This project proposes a CNN-based model for classification of flower species using image data set. The said image data set consists of five flower types and is sourced from Kaggle Flowers. As stated in the most part of the circumstances these flowers will be subjected to augmentation that is performed in order to enhance the model diversity. This multi-layered Convolutional Neural Network's (CNN) structure was built out of CONV2D layers with potential pooling activities to eliminate or capture certain features. It shows that the model was able to register 99.09% accuracy out of total 4,323 images classification task.

To make it easy for the users, an interface was created in which users can upload pictures and view automatic identification of the flowers in real time. Reliability of the evaluation is verified by different metrics such as precision, recall and F1-score among others. This gives assurance that the proposed system can accurately classify flowers and it is easy to operate and flexible.

ARCHITECTURE:



DATASET:

The answer is considering the case of In this sense, it is means have achieved a cade that the Kaggle Flowers dataset is a collection of images which consist of 4,323 of the flower images. More specifically, this collection contains the images categorized into 5 types of flowers which are daisy, dandelion, rose, sunflower, and tulip as for each flower category around 1000 images approximate images of different resolution, lighting and angles The dataset is therefore further divided into subsets of training, validation and testing for proper evaluation of the models to be constructed on the basis of the bloom flowers dataset. Additionally, rotation and flipping and scaling are included in the load and do not overfit. In this manner, the approach and usage of the dataset, being not too complicated and containing enough variety to train CNNs enables to create precise and stable model for classifying flowers.

METHODOLOGY:

Dataset Preparation and Loading:

Prepare a Kaggle Flowers dataset and sort it into five groups; daisy, dandelion, rose, sunflower and tulip

Divide the dataset into training set (70%) validation set (15%) and testing set (15%).

Data Augmentation:

Use augmentation techniques to increase the variance of the dataset, such as:

Rotation: A new angle or several angles is generated of flower pictures.

Flipping: Making images mirrored.

Scaling and Cropping:

Resize the image but without losing any important features.

Model Architecture Design:

Deploy a Convolutional Neural Network (CNN) equipped with CONV2D layers for feature mapping.

Incorporate image max pooling layers to decrease image dimensions while extracting some other important components.

For multi-scale feature extraction, stack layers of kernels of various sizes (e.g., 62x62, and 31x31).

Model Development:

Set up training parameters including: batch size of 32, learning rate of 0.001 and 20 epochs.

Employ Adam optimizer for effective update of weights and loss function as categorical cross-entropy.

Conduct training of the model on 4323 images while checking accuracy and loss to prevent overfitting.

Model Performance Testing:

Validate the model performance metrics such as model generalization on images that were not previously employed in training.

Utilize accuracy, precision, recall, F1-score, and other metrics to evaluate performance.

A high overall classification accuracy of 99.09 % is reported corroborating model validity.

System Implementation:

Engage users by developing a GUI based application which allows an easy submission of images for classification in a batch or in real time.

Develop necessary features such as loading datasets, loading training data, predicting test images, etc.

Implementation and Evaluation:

Present the model integrated with the GUI and test it on new images.

Confirm reliability of the model by testing with different images under different conditions.

Performance Improvement:

Focus on balancing accuracy and computation by adjusting hyperparameters.

Use regularization techniques, such as dropout during training to avoid overfitting.

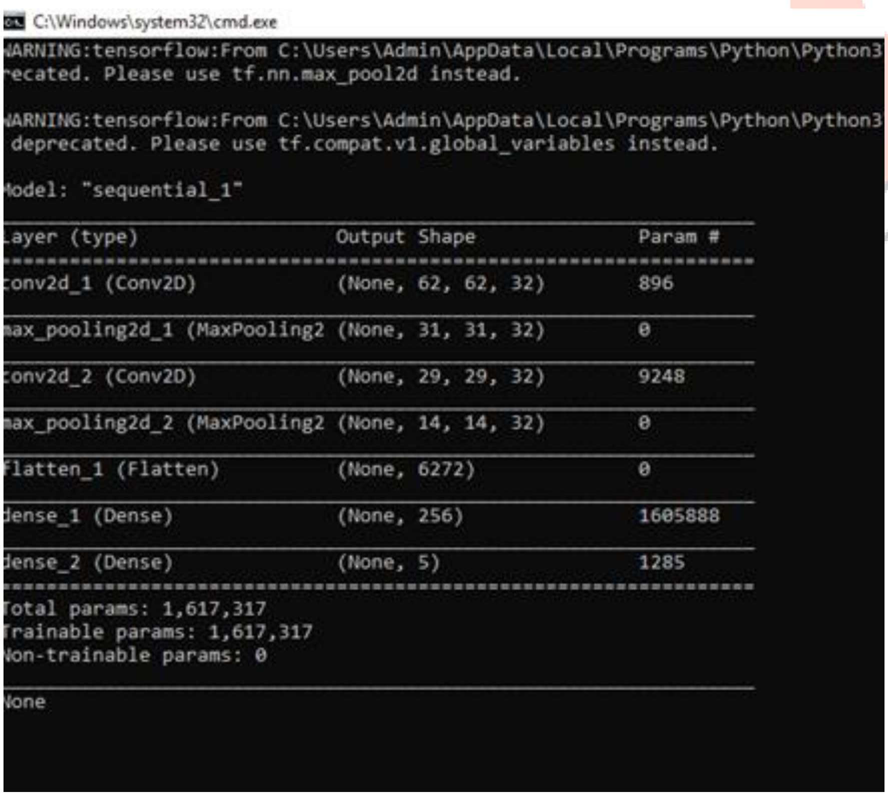
EVALUATION:

Accuracy:

Formula: $$\text{Accuracy} = \frac{\text{Correct Predictions}}{\text{Total Predictions}}$$

RESULTS:

We can see CNN trained on total 4323 images and the trained model has prediction accuracy percentage as 99.09.



In above screen to train CNN we have used CONV2D network and we create multiple layers with different image sizes as 62 X 62, 31 X 31 and many more

Flower name predicted as ‘daisy’

Predicted flower name as rose

CONCLUSION

This project showcases the efficacy of CNNs in the classification of flower images with high accuracy and robustness. Using the Kaggle Flowers dataset, the model resolves issues such as dataset diversity and computational power by attaining an impressive accuracy of 99.09%. It is further provided with a graphical user interface that improves usability of the solution, thus making the system applicable in real life situations in botany, education, and retail. This work is an extension to the theoretical work as it demonstrates how AI powered solutions can be useful in solving image classification problems. Future work could look at increasing variability in the dataset used as well as incorporating more species of flowers for wider use.

REFERENCES:

[1] Lillesand, T.M. and Kiefer, R.W. and Chipman, J.W., in "Remote Sensing and Image Interpretation" 5th ed. Wiley, 2004

[2] Li Deng and Dong Yu "Deep Learning: methods and applications" by Microsoft research [Online] available at: http://research.microsoft.com/pubs/209355/NOW-Book-RevisedFeb2014-online.pdf

[3] McCulloch, Warren; Walter Pitts, "A Logical Calculus of Ideas Immanent in Nervous Activity", Bulletin of Mathematical Biophysics 5

(4): 115–133(1943) [4] An introduction to convolutional neural networks [Online]available at:http://white.stanford.edu/teach/index.php/An_Introduction_to _Convolutional_Neural_Networks [5]

[5] Hubel, D. and Wiesel, T. (1968). Receptive fields and functional architecture of monkey striate cortex. Journal of Physiology (London), 195, 215–243C. J. Kaufman, Rocky Mountain Research Laboratories, Boulder, Colo., personal communication, 1992. (Personal communication)

[6] Yann LeCun, Leon Bottou, YodhuaBengio and Patrick Haffner, "Gradient -Based Learning Applied to Document Recognition", Proc. Of IEEE, November 1998.

[7] S. L. Phung and A. Bouzerdoum,"MATLAB library for convolutional neural network," Technical Report, ICT Research Institute, Visual and Audio Signal Processing Laboratory, University of Wollongong. Available at: http://www.uow.edu.au/˜phung

[8] Tutorial on deep learning [Online] available at :http://deeplearning.net/tutorial/lenet.html

[9] Adelson, Edward H., Charles H. Anderson, James R. Bergen, Peter J. Burt, and Joan M. Ogden. "Pyramid methods in image processing." RCA engineer 29, no. 6 (1984): 33-41.

[10] M. Riedmiller and H. Braun, "A direct adaptive method of faster backpropagation learning: The rprop algorithm", in IEEE International Conference on Neural Networks, San Francisco, 1993, pp. 586– 591.

[11] S. L. Phung, A. Bouzerdoum, and D. Chai, "Skin segmentation using color pixel classification: analysis and comparison," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 27, no. 1, pp. 148–154, 2005.

[12] Yi Yang and Shawn Newsam, "Bag-Of-Visual-Words and Spatial Extensions for Land-Use Classification",ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM GIS), 2010.

[13] J. Xiao, J. Hays, K. Ehinger, A. Oliva, and A. Torralba, "SUN Database: Large-scale Scene Recognition from Abbey to Zoo", IEEE Conference on Computer Vision and Pattern Recognition (CVPR)

[14] J. Xiao, K. A. Ehinger, J. Hays, A. Torralba, and A. Oliva, "SUN Database: Exploring a Large Collection of Scene Categories", (in revision) International Journal of Computer Vision (IJCV)

[15] Source for highway images [Online] National Highway Authority of India, nhai.org

[16] S. Daniel Madan Raja1, Dr.A.Shanmugam, "ANN and SVM Based War Scene Classification using Wavelet Features:A Comparative Study", Journal of Computational Information Systems 7:5 (2011) 1402-1411
[17] Source for war scene images [Online] available at: military.com and militaryfactory.com